GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
MBS2

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Key to Mark Scheme

M	mark is for	method
m	mark is dependent on one or more M marks and is for	method
A	mark is dependent on M or m marks and is for	accuracy
B	mark is independent of M or m marks and is for	accuracy
E	mark is for	explanation
√or ft or F		follow through from previous incorrect result
cao		correct answer only
cso		correct solution only
awfw		anything which falls within
awrt		anything which rounds to
acf		any correct form
ag		answer given
sc		special case
oe		or equivalent
sf		significant figure(s)
dp		decimal place(s)
A2,1		2 or 1 (or 0) accuracy marks
–*x* ee		deduct *x* marks for each error
pi		possibly implied
sca		substantially correct approach

Abbreviations used in Marking

MC – *x*	deducted *x* marks for mis-copy
MR – *x*	deducted *x* marks for mis-read
isw	ignored subsequent working
bod	given benefit of doubt
wr	work replaced by candidate
fb	formulae book

Application of Mark Scheme

No method shown:	
Correct answer without working	**mark as in scheme**
Incorrect answer without working	**zero marks unless specified otherwise**
More than one method / choice of solution:	
2 or more complete attempts, neither/none crossed out	**mark both/all fully and award the mean mark rounded down**
1 complete and 1 partial attempt, neither crossed out	**award credit for the complete solution only**
Crossed out work	**do not mark unless it has not been replaced**
Alternative solution **using a correct or partially correct method**	**award method and accuracy marks as appropriate**

Mathematics and Statistics B Statistics 2 MBS2 June 2004

Question Number and Part	Solution	Marks	Total marks	Comments
1(a)	$p = \frac{18}{200} = 0.09$	B1		
	$0.09 \pm 1.6449\sqrt{\frac{0.09 \times 0.91}{200}}$	B1 M1 M1		1.6449 (or 1.64, 1.645,....) attempted use of Normal $\sqrt{\frac{0.09 \times 0.91}{200}}$
	0.09 ± 0.0333			
	(0.0567, 0.1233)	m1		allow wrong z
	(0.0567, 0.123)	A1	6	0.056 to 0.057 0.123 to 0.124
(b)	CI suggests between 5.67% and 12.3% are faulty. This is greater than 5%.	B1√		
	Supplier can return batch.	B1	2	
	Total		**8**	
2(a)	$\frac{24}{8} = 3$			
	Select a number randomly between 1-3 Select every third name	B1 B1 B1		Randomly select starting point periodcially select name every third
	CFILORUX	M1		CODPEQFR
	(or DGJMPSVY EHKNQTWZ)	A1	5	(or GSHTIUJV KWLXMYNZ)
(b)	Equally likely – each athlete has probability $\frac{1}{3}$	B1 B1	2	
(c)	Not random sample – CD (or equivalent) cannot occur in sample.	B1 B1	2	
	Total		**9**	

MBS2 (cont)

Question Number and Part	Solution	Marks	Total marks	Comments
3(a)	$p = \frac{421+498+366+313}{4} = 399.5$	B1 B1	2	numerator denominator
(b)(i)	$y = –5.747x + 399.892$	B2 B2	4	m and c correct to 3s.f. **sc** M1 A1, M1 A1 if eqns used
	$y = –5.75x + 400$			($y = – 7.74x + 427$ B0)
(ii)	When $x = 11.5$ m.a. = 333.8	B1 M1 A1	3	$x = 11.5$
(c)(i)	Line (0, 400) (10, 342.5)	M1 A1	2	
(ii)	421 – 404 = 17 378 – 380 = –2 384 – 356 = 28	M1		Seasonal effects
	$\frac{43}{3} = 14.3$	M1 A1	3	Average seasonal 13 to 16
(iii)	333.8 + 14.3 = 348.1	M1		b(ii) or graph + c(ii)
	£348,000	A1	2	343 to 353 (000)
	Total		**16**	

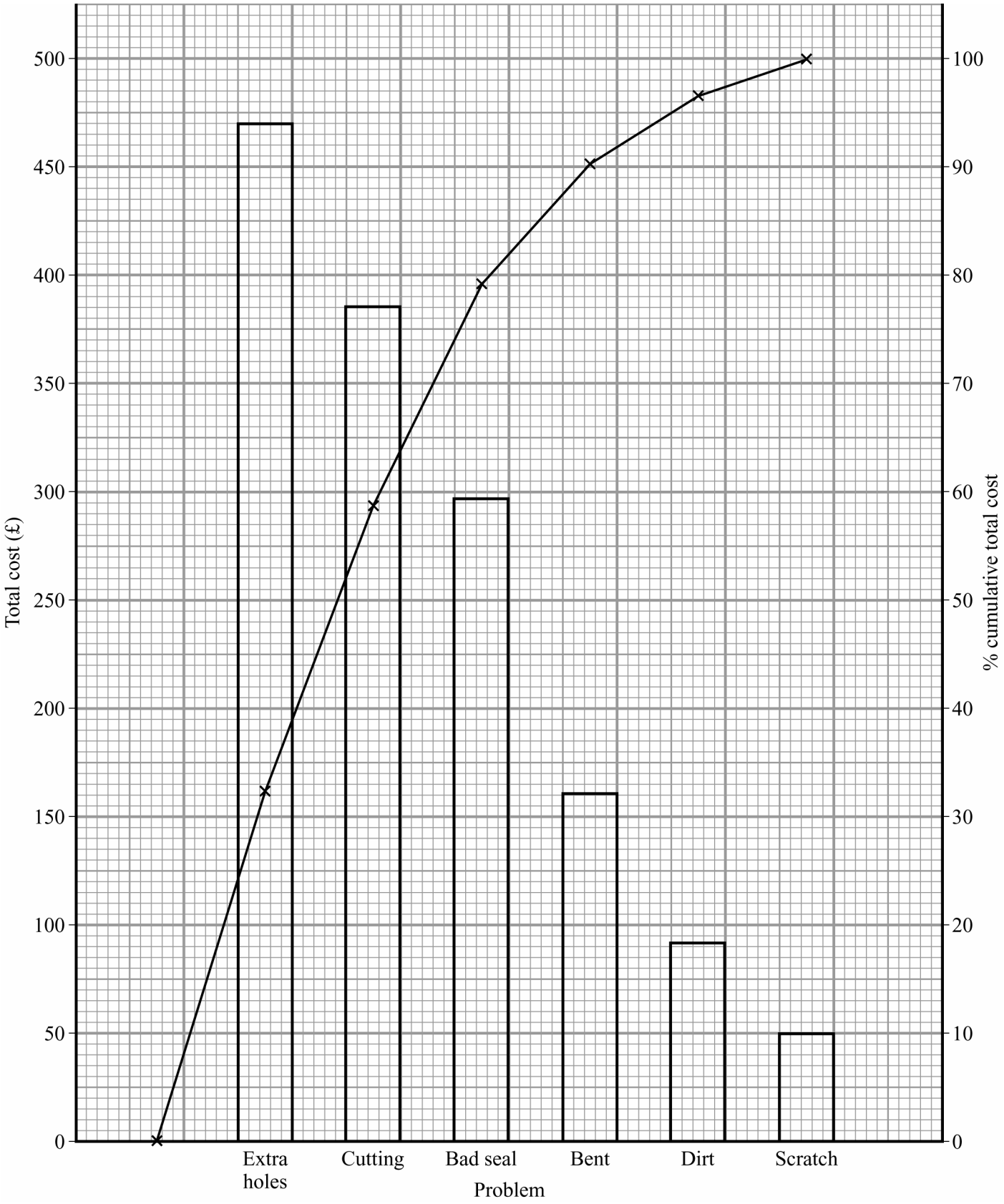
MBS2(cont)

<table>
<tr><th>Question Number and Part</th><th>Solution</th><th>Marks</th><th>Total marks</th><th>Comments</th></tr>
<tr><td>4(a)</td><td>Dirt, Cutting and Bad seal</td><td>B2,1</td><td>2</td><td>B1 any two
B2 all three correct
B1 four answers</td></tr>
<tr><td>(b)(i)</td><td><table><tr><td>Problem</td><td>Total cost</td></tr><tr><td>Bad seal</td><td>297</td></tr><tr><td>Bent</td><td>161</td></tr><tr><td>Cutting</td><td>385</td></tr><tr><td>Dirt</td><td>92</td></tr><tr><td>Extra holes</td><td>470</td></tr><tr><td>Scratch</td><td>50</td></tr></table></td><td>M1
A1</td><td>2</td><td></td></tr>
<tr><td>(ii)</td><td><table><tr><td>Problem</td><td>Total cost</td><td>Cum.total cost</td><td>% cum. Total cost</td></tr><tr><td>Ex.holes</td><td>470</td><td>470</td><td>32.3</td></tr><tr><td>Cutting</td><td>385</td><td>855</td><td>58.8</td></tr><tr><td>Bad seal</td><td>297</td><td>1152</td><td>79.2</td></tr><tr><td>Bent</td><td>161</td><td>1313</td><td>90.2</td></tr><tr><td>Dirt</td><td>92</td><td>1405</td><td>96.6</td></tr><tr><td>Scratch</td><td>50</td><td>1455</td><td>100.0</td></tr></table></td><td>M1
M1
M1
A1</td><td>4</td><td>Ranking
Cum. total cost
% cum. total cost</td></tr>
<tr><td>(iii)</td><td>(see diagram on next page)
Bar chart

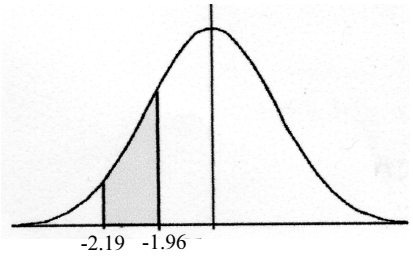
% cumulative total costs polygon</td><td>M1
A1
M1
A1</td><td>4</td><td></td></tr>
<tr><td>(iv)</td><td>Extra holes, cutting, bad seal</td><td>B1
B1</td><td>2</td><td>Any two
All three</td></tr>
<tr><td>(c)</td><td>Cutting</td><td>B1</td><td>1</td><td></td></tr>
<tr><td></td><td>Total</td><td></td><td>15</td><td></td></tr>
</table>

MBS2 (cont)

Diagram for Question 4



MBS2 (cont)

Question Number and Part	Solution	Marks	Total marks	Comments
5(a)	$n = 300$ $p = 0.006$ $np = 1.8$			
	Use Poisson	B1		
	P $(X \leq 6) = 0.9974$	M1		
	P $(X \leq 2) = \underline{0.7306}$	M1		
	P $(3 \leq X \leq 6) = 0.2668$	M1		
	≈ 0.267 (3 sig. fig.)	A1	5	0.266 to 0.267
(b)	$n = 90$ $p = 0.3$			
	$np = 27$ $npq = 18.9$	B1		
	use Normal	B1		
	$\frac{17.5 - 27}{\sqrt{18.9}} = \frac{-9.5}{\sqrt{18.9}} = -2.185$	M1		Method *z*
		M1		Continuity correction
	≈ -2.19			
	$\frac{18.5 - 27}{\sqrt{18.9}} = -1.955$			
	≈ -1.96	A1		Both correct –2.18 to –2.19 –1.95 to –1.96
				
	$\begin{array}{r} 0.98574 \\ -\ 0.97500 \\ \hline 0.01074 \end{array}$	m1		Must have 27, $\sqrt{18.9}$
	P $(X = 18) = 0.0107$	A1	7	0.0103 to 0.011
	Total		**12**	
	TOTAL		**60**	